BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION OF CROWNED RIDGE, LLC FOR A FACILITIES PERMIT TO CONSTRUCTION 300 MEGAWATT WIND FACILITY

Docket No. EL19-003

REBUTTAL TESTIMONY AND EXHIBITS

OF DR. ROBERT MCCUNNEY

May 24, 2019

INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Dr. Robert McCunney. My business address is PO Box 29077, Charlestown MA 02129.

Q. **BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?**

A. Brigham and Women's Hospital, Boston, MA; Staff physician in Pulmonary, Center for Chest Diseases; Role: I perform clinical evaluations and recommend treatment of occupational and environmental illnesses and serve in an educational capacity as part of Harvard Medical School faculty position. My curriculum vitae is attached as Exhibit RM-R-1.

Q. **WHAT ARE YOUR RESPONSIBILITIES?**

A. I was hired by Crowned Ridge Wind, LLC ("CRW") to submit rebuttal testimony and testify in this proceeding on the health and welfare issues and concerns raised in the testimony of Staff and proposed conditions of the Intervenors.

Q. **PLEASE DESCRIBE YOUR BACKGROUND AND QUALIFICATIONS.**

A. In summary, I am a licensed practicing physician. I completed training as a specialist in internal medicine and am also board certified in occupational and environmental medicine. My background in noise and health includes post graduate residency training in occupational medicine at Harvard, as an author of peer reviewed publications, such as three book chapters on occupational noise exposure; clinical experience in reviewing audiometric tests of workers exposed to noise and experience related to occupational

hearing conservation programs. With respect to wind turbines and health, I am the lead author of a critical review of the scientific literature on wind turbines and health sponsored by the Massachusetts Institute of Technology and published in the Journal of Occupational and Environmental Medicine in 2014; a co-author of a document entitled "Wind Turbines and Health"; (Colby et al, 2009) and lead author of a mathematical analysis of a proposed case definition related to health and living proximity to wind turbines. (Full citations are set forth in Exhibit RM-R-1). In addition, I have lectured to scientific, professional and lay audiences in numerous settings in the USA and Canada on wind turbines and health. I have also been admitted as an expert to testify in wind turbine hearings in numerous jurisdictions in the USA and Canada.

Q. HAS THIS TESTIMONY BEEN PREPARED BY YOU OR UNDER YOUR DIRECT SUPERVISION?

A. Yes.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION?

A. No.

Q. PLEASE DESCRIBE THE PURPOSE OF YOUR REBUTTAL TESTIMONY.

A. The purpose of my testimony is to respond to Intervenors' proposed conditions as set forth in Staff witness Darren Kearney's Direct Testimony, Exhibit DK-8.

Sound Study

Intervenors' Proposed Conditions

Q. THE INTERVENORS' PROPOSED CONDITION 1 (KEARNEY EXHIBIT DK-8) WOULD REQUIRE THE FOLLOWING : THAT THERE BE A 2 MILE SETBACK FROM ALL NON-PARTICIPATING LANDOWNERS, BASED ON THE ASSUMPTION THAT THEY SHOULD NOT BE EXPOSED TO THE EFFECTS OF THE PROJECT. IS SUCH A CONDITION NEEDED TO ADDRESS A HEALTH OR WELFARE CONCERN FOR NON-PARTICIPANTS?

A. A two mile setback is not necessary for non-participating landowners. Moreover, the most appropriate scientific measure of potential health impacts from a noise generating source, including wind turbines, is to model or measure the noise levels outside of the home. One can then assess these noise levels in the context of scientific studies and regulations. I am unaware of any scientific peer reviewed study in the world's literature that indicates the necessity of a two mile setback. In fact, to the contrary, results of the largest epidemiology study that evaluated health issues associated with living in proximity to wind turbines noted no adverse health effects, including sleep and stress, among others, at noise levels up to 46 dB. (Michaud et al, 2016 -- Exhibit CO-11). As far as I am aware, no scientific studies indicate that wind turbine operations can generate sound to 46 dB or higher two miles from the source.

Q. THE INTERVENORS' PROPOSED CONDITION 2 (KEARNEY EXHIBIT DK-8) WOULD REQUIRE THAT THERE BE A 2 MILE SETBACK FROM THE WAVERLY SCHOOL TO PROTECT CHILDREN FROM DISTURBANCES

FROM THE PROJECT WHILE IN THEIR LEARNING ENVIRONMENT. IS SUCH A CONDITION NEEDED TO ADDRESS A HEALTH OR WELFARE CONCERN FOR THE STUDENTS AT WAVERLY?

A. No, it is not. As part of my work on this rebuttal, I reviewed the distances and noise levels from the nearest turbines to the school. The modeled sound level at Waverly School was 39 dBA and the closest turbine is 6,207 feet away. In light of these noise levels and the absence of any scientific support that such noise levels would interfere with the children's learning and behavior as well as health, this setback is safe for the school children.

Q. THE INTERVENORS' PROPOSE A NUMBER OF CONDITIONS (KEARNEY EXHIBIT DK-8) RELATED TO MEASUREMENT AND MONITORING OF INFRASOUND. ARE THESE CONDITIONS NEEDED TO ADDRESS A HEALTH OR WELFARE CONCERN?

A. Such conditions are not necessary. It is not necessary to differentiate low frequency sound or infrasound from broad noise level measurements conducted in the A scale. (See, Berger et al, 2015, which is Exhibit CO-6). Further, recent reviews conclude that there is no scientific evidence to support the hypothesis that wind turbine infrasound and low-frequency sound have unique adverse health effects that other sources of noise do not have. (McCunney et al, 2014 – Exhibit CO-8)

In summary, although wind turbines can generate infrasound and low-frequency sound, detectable levels of infrasound and low-frequency sound at residences are not at harmful levels based on studies near wind farms in the United States, the United Kingdom, the Netherlands, Denmark, and Australia. No studies demonstrate harmful effects to humans as a result of exposure to infrasound or low-frequency sound at the noise levels measured in the vicinity of wind turbines or in experimental studies involving noise levels several orders of magnitude higher than those noted in the vicinity of wind turbines.

Q. THE INTERVENORS' PROPOSED CONDITIONS 19, 20, AND 21 (KEARNEY EXHIBIT DK-8) WOULD LIMIT SOUND AT 40 DBA AT THE PROPERTY LINE OF A NON-PARTICIPATING PROPERTY OWNER. IS SUCH A CONDITION NEEDED TO ADDRESS A HEALTH OR WELFARE CONCERN?

A 40 dBA limit outside of a non-participant's home is not necessary to prevent adverse health effects from noise. The Health Canada study, the largest epidemiology study in the world, found no adverse health effects, including sleep, stress, and blood pressure, among others, at noise levels up to 46dB. (Michaud et al, 2016 – Exhibit CO-3).

Q. A NUMBER OF THE INTERVENORS' CONDITIONS (KEARNEY EXHIBIT DK-8) ARE PREMISED ON PEOPLE COMPLAINING ABOUT PHYSICAL CONDITIONS OR HEALTH ISSUES THEY BELIEVE ARE BROUGHT ON BY THE CRW WIND PROJECT. DO YOU HAVE AN OPINION ON WHETHER CONDITIONS SHOULD BE IMPOSED BECAUSE PEOPLE MAY ATTRIBUTE A PHYSICAL OR HEALTH ISSUE TO THE CRW WIND PROJECT?

A. I disagree that such a condition would be appropriate. There is no direct link between wind projects and adverse impact on health. To understand why, it is important to distinguish the process involved in diagnosing symptoms in contrast to determining the cause of symptoms. Below, I outline a well-accepted method to evaluate whether symptoms may be due to exposure to an occupational or environmental hazard and use sleep disturbances as an example.

In determining the cause of a disease or symptoms, the essential first step in the process is forming a diagnosis. It is necessary to establish a diagnosis based on accepted medical criteria. For example, the National Heart Lung and Blood Institute of the USA have proposed objective criteria for the diagnosis of asthma since the disorder is widely recognized to be "over diagnosed". (NHLBI, 2007 – Exhibit RM-R-2). In population surveys, the prevalence of self-reported asthma may be as high as 10%, whereas asthma diagnosed according to widely accepted criteria is about 5%. The point of this example is that any causality assessment needs to begin with an accurate diagnosis of the symptoms, based on well-accepted criteria. Once a diagnosis is made, one can then assess its potential cause. It is critical in this process, however, to conduct a routine procedure performed by physicians known as a differential diagnosis. In short, most symptoms have numerous causes. Headaches, for example, can occur due to a major illness like a brain tumour, as well as stress, and alcohol abuse, among others. A differential diagnosis is the process by which a physician considers these various explanations as the cause of a patient's symptoms through a medical history and appropriate diagnostic studies.

In my experience, patients' own self-assessments of causes of symptoms, although potentially helpful in the evaluation, can often be incorrect. For instance, if sleep disturbance is misattributed to wind turbines, serious treatable illnesses could be overlooked. In fact, recall bias, a well-recognized factor in epidemiological studies, can distort the accuracy of a person's recall. This phenomenon of recall bias has been confirmed in studies of breast cancer, Parkinson's disease and coronary artery disease (Rugbjerg et al, 2011 Zota et al, 2010 and Metcalfe et al, 2008, attached as Exhibit RM-R-3). In fact, Zota et al noted that their "results highlight the difficulty of distinguishing in retrospective self-report studies between valid associations and the influence of recall bias." Further, Metcalfe et al concluded, "Recall is likely to be influenced by present outcome" (Metcalfe et al, 2008). The point of this commentary is to demonstrate the limited utility of recall when evaluating self-reported symptoms. These comments are not intended to discredit or ignore a person's own assessment of causality but in contrast, to place in perspective the shortcomings and uncertainty in relying on recall to document events and timing thereof in the past.

What follows is a summary of the steps involved in forming a causality assessment. A critical component in assessing potential environmental illness is an evaluation of the exposure, which in this case is noise and its components, such as low frequency sound and infra sound, associated with wind turbine operations. A causality assessment where noise exposure may be a factor should also consist of a thorough review of noise measurements conducted in the vicinity of the individual's home along with a comparison of the symptoms, diagnosis and noise levels in light of what has been published in the peer reviewed scientific literature.

In addition, it is equally important to understand that in contrast to a placebo response in which favorable expectations can influence favorable outcomes in clinical practice and pharmaceutical research, a nocebo response refers to new or worsening symptoms produced by negative expectations that being treated with, or exposed to, an external stimuli will cause adverse health effects (Colloca et al, 2012; Hauser et al. 2012; Webster et al, 2016; Dodd et al; 2017 and Chavaria et al, 2017, attached as Exhibit RM-R-4)). A nocebo response is a well-recognized phenomenon in medical practice and can affect the integrity of pharmaceutical research and patient compliance with treatment, among others. For example, in clinical trials, expectations can influence the reporting of symptoms, such as side effects of a medication or a medical procedure involving informed consent (Ruan et al, 2016 – Exhibit RM-R-5), and adherence to treatment, (Tobert et al, 2016 – Exhibit RM-R-6) among others. This matter can have serious clinical and therapeutic impacts if symptoms that are misattributed to the medication lead to poor therapeutic responses, as a result of poor compliance-not taking the medications.

Thus, in trying to understand why some people are more apt to report annoyance in the context of wind turbines, it is important to consider how nocebo effects may contribute to self-reported symptoms. In a nocebo reaction, people expect untoward reactions and develop symptoms in ***anticipation*** of an event, in this case, wind turbine operations. (Dodd et al, 2017 – Exhibit RM-R-4). Indeed, a study analyzed Canadian newspaper coverage of wind turbines and found that media coverage might contribute to nocebo responses. (Deignan et al, 2013 – Exhibit RM-R-7)

Chapman, (et al, 2013 – Exhibit RM-R-8) also explored patterns of formal complaints (health and noise) made in relation to 51 wind farms in Australia from 1993 to 2012.

Very few complaints were formally lodged; only 129 individuals in Australia formally or publicly complained during the time period studied; the majority of wind farms had no complaint made against them. Complaints increased around 2009 when "wind turbine syndrome" was introduced. The authors concluded that nocebo effects likely play an important role in wind farm health complaints. People living near large wind farms filed the most complainants (16 out of 18; r=0.32) Furthermore, the strongest predictor of a formal complaint was the presence of an opposition group in the area of the wind farm. Opposition groups were present in 15 of the 18 sites that filled complaints while only 1 opposition group was present in the 33 areas that did not file a complaint (r=0.82). Accordingly, these studies show that while there may be a perceived health impact from wind farms, the health complaints do not correlate to actual adverse health impacts.

Q. **A NUMBER OF THE INTERVENORS' CONDITIONS (KEARNEY EXHIBIT DK-8) ARE PREMISED ON PEOPLE BEING ANNOYED BY THE WIND PROJECT. DO YOU HAVE AN OPINION ON WHETHER CONDITIONS SHOULD BE IMPOSED BECAUSE PEOPLE COULD BE ANNOYED BY THE CRW WIND PROJECT?**

A. My opinion is that such conditions are inappropriate. Annoyance is one of the most common assessments made in environmental noise studies, including those related to wind turbines. However, many factors can contribute to a person reporting "annoyance" in the context of living near wind turbines, including attitudes towards the turbines, visual aspects of the turbines, and whether a person derives economic benefit and noise from the turbines. (Pedersen et al, 2010 – Exhibit RB-R-9)

Annoyance is an outcome measure that has been used in environmental noise studies, primarily self-completed questionnaires. Noise levels, however, account for only a modest portion of self-reported annoyance in the context of wind turbines. (Knopper & Ollson, 2011 (Exhibit CO-2), McCunney et al, 2014 (Exhibit CO-8) and Michaud et al, 2016 Exhibit CO-11). Further, in the Health Canada study (Exhibit CO-3), annoyance was related to several reported measures of health and well-being, although these associations were statistically weak ($R^2 < 0.09\%$), independent of wind turbine noise ("WTN") levels, and not retained as a significant predictive variable in multiple regression models. A correlation coefficient (R^2) of 0.09 is extremely weak and indicates that the wind turbine noise category alone was a weak predictor of whether or not an individual was highly annoyed by WTN or not. The Health Canada study confirmed earlier research in which noise from wind turbines was noted to play a minor-if any- role in people reporting annoyance, in contrast to more significant factors, such as attitudes towards wind turbines, the impact of visual factors on the landscape and finally whether a person derives economic benefit from the turbines, a group that is completely absent of reported annoyance, despite residing in areas with the highest WTN levels. Therefore, sound pressure levels appear to play a limited-role in the experience of annoyance associated with wind turbines, a conclusion similar to that reached by Knopper & Ollson (2011) – Exhibit CO-2.

Further, self-reported annoyance is not coded as a specific diagnosis in the International Classification of Diseases. (ICD, 10^{th} edition) The ICD is used worldwide for diagnostic, insurance and research purposes. Accordingly, I do not view that annoyance is sufficiently supported as a reason to adopt the Intervenors conditions or require a

reduction in the sound and shadow/flicker thresholds proposed by CRW – 30 hours of shadow/flicker a year and 50 dBA at a participant's residence, and 45 dBA at a non-participant's residence.

Q. GIVEN THE INTERVENORS CONDITIONS THAT ARE CRITICAL OF THE PROPOSED CRW SETBACKS FOR TURBINES FOR THE CRW PROJECT, ARE THE PROPOSED TURBINE PLACEMENT AND SETBACKS PROPOSED BY CRW SUFFICIENT TO NOT SUBSTANTIALLY IMPAIR THE HEALTH OR WELFARE OF NON-PARTICIPANTS?

A. Yes. The proposed turbine placement and setbacks proposed by CRW will not substantially impair the health or welfare of non-participants. I based the conclusion on a variety of factors, including the sound and shadow/flicker results developed by CRW witness Jay Haley; my professional experience as a physician addressing health risks from noise; and the scientific peer reviewed literature.

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A. Yes, it does.